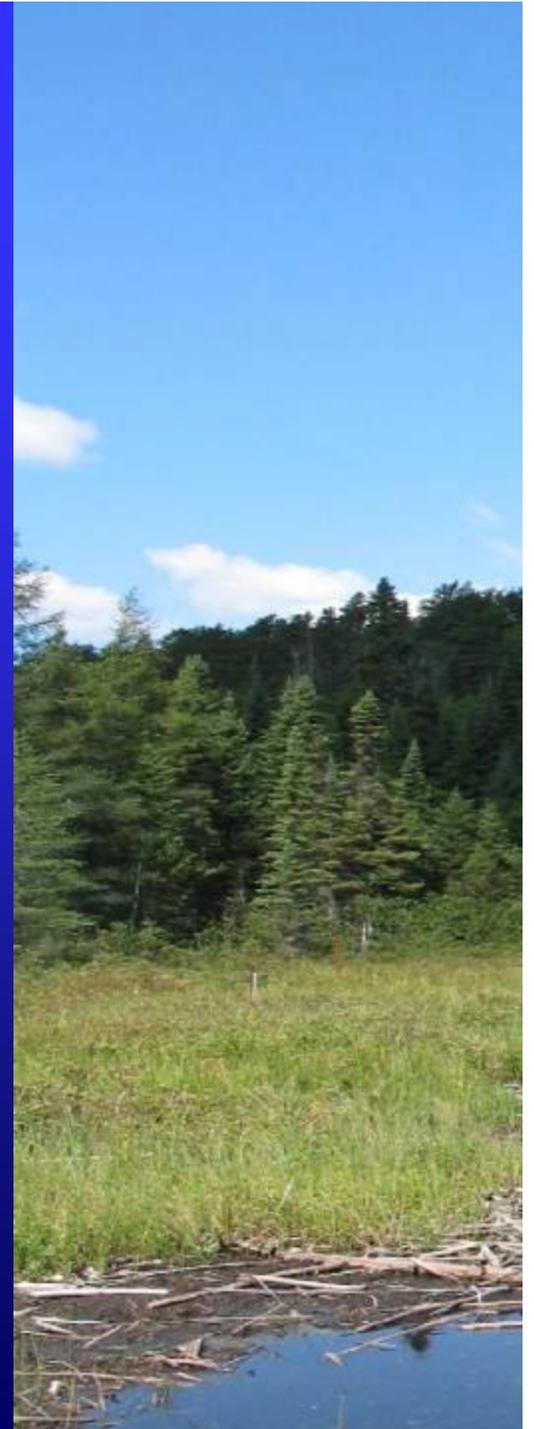


Mercury Contamination of the Environment: An Overview

David Krabbenhoft
US Geological Survey
Middleton, Wisconsin



Presentation Outline:

- Background of the “mercury problem”
- Current understanding and present research directions
- Relevance to DOI Lands



Mercury problem discovery and resolution?



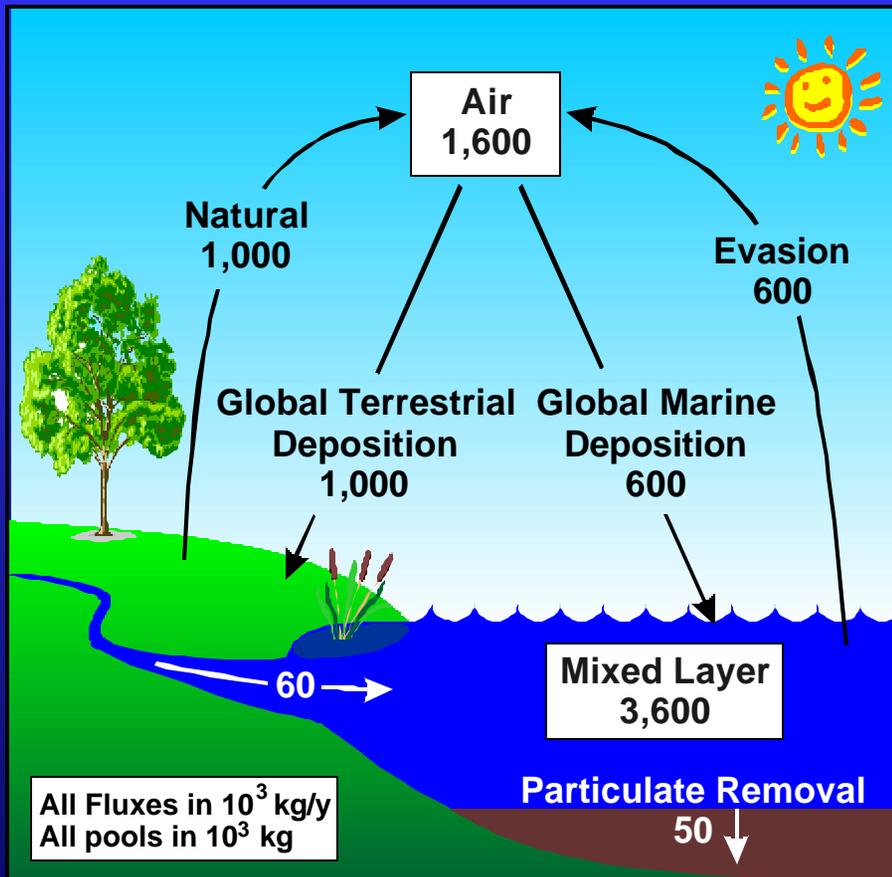
- 1980's: link to atmospheric emissions
- 1990's: advances in understanding: cycling, fate, and toxicology
- Present: scientific synthesis and linking science & policy to develop responsible and effective regulations

Consequences of Mercury (Methylmercury) Contamination of Fish

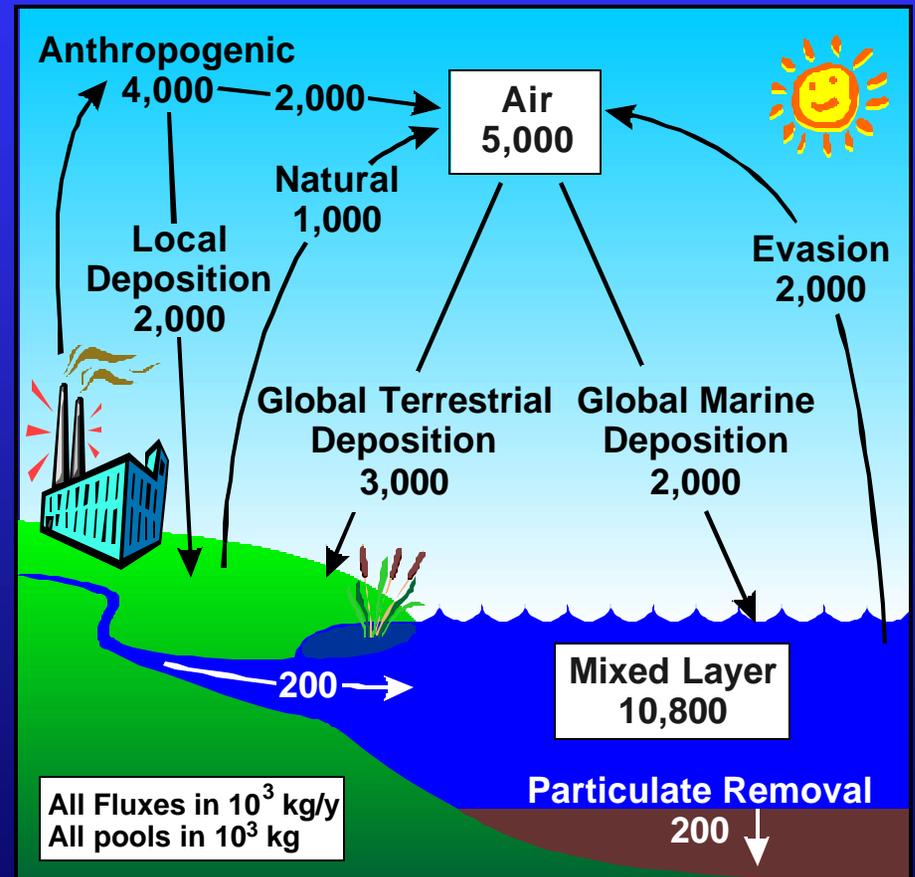
- Direct health effects on humans and fish-eating wildlife
- Loss or degradation of a consumable resource having socioeconomic, nutritional, cultural, and recreational value
- Socio-cultural damage to people who fish for subsistence

Mercury Then and Now

Pre-industrial

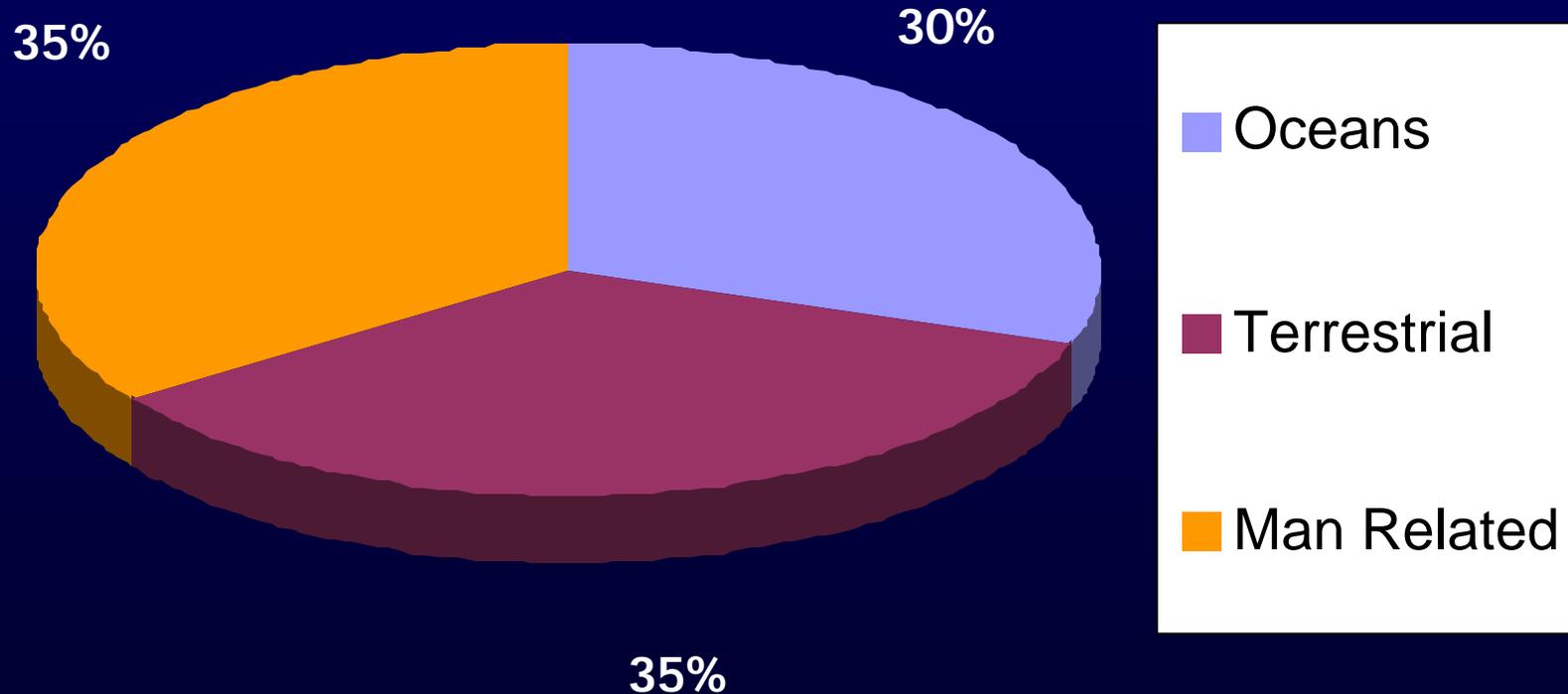


Current



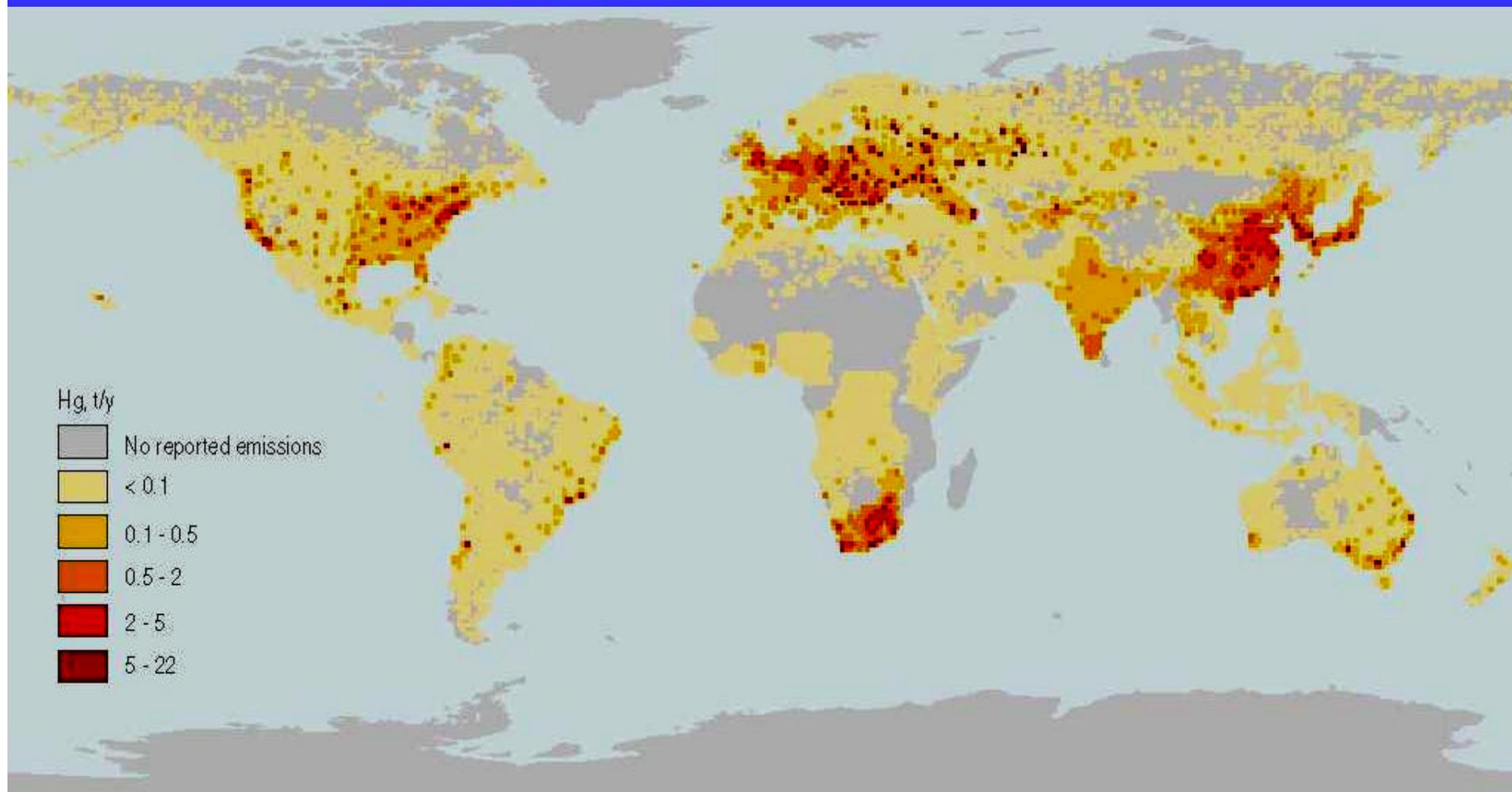
Mason et al. 1994

Global Atmospheric Mercury Emissions (percent of 7260 tons per year)



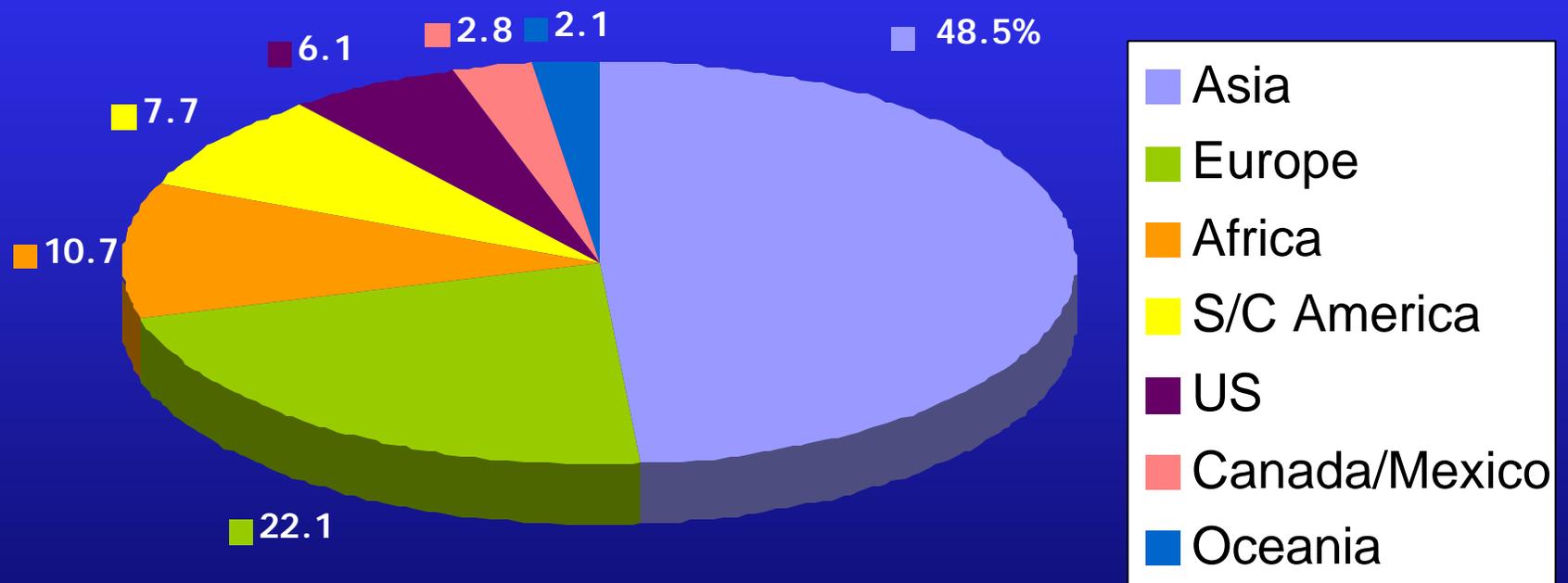
Source: EERC Rept., v. 9, no. 1, 2003

Spatial distribution of global emissions of mercury to air



Source: UNEP Global Mercury Assessment, 2002, using J. Pacyna 1995 data, as presented by AMAP (1998).

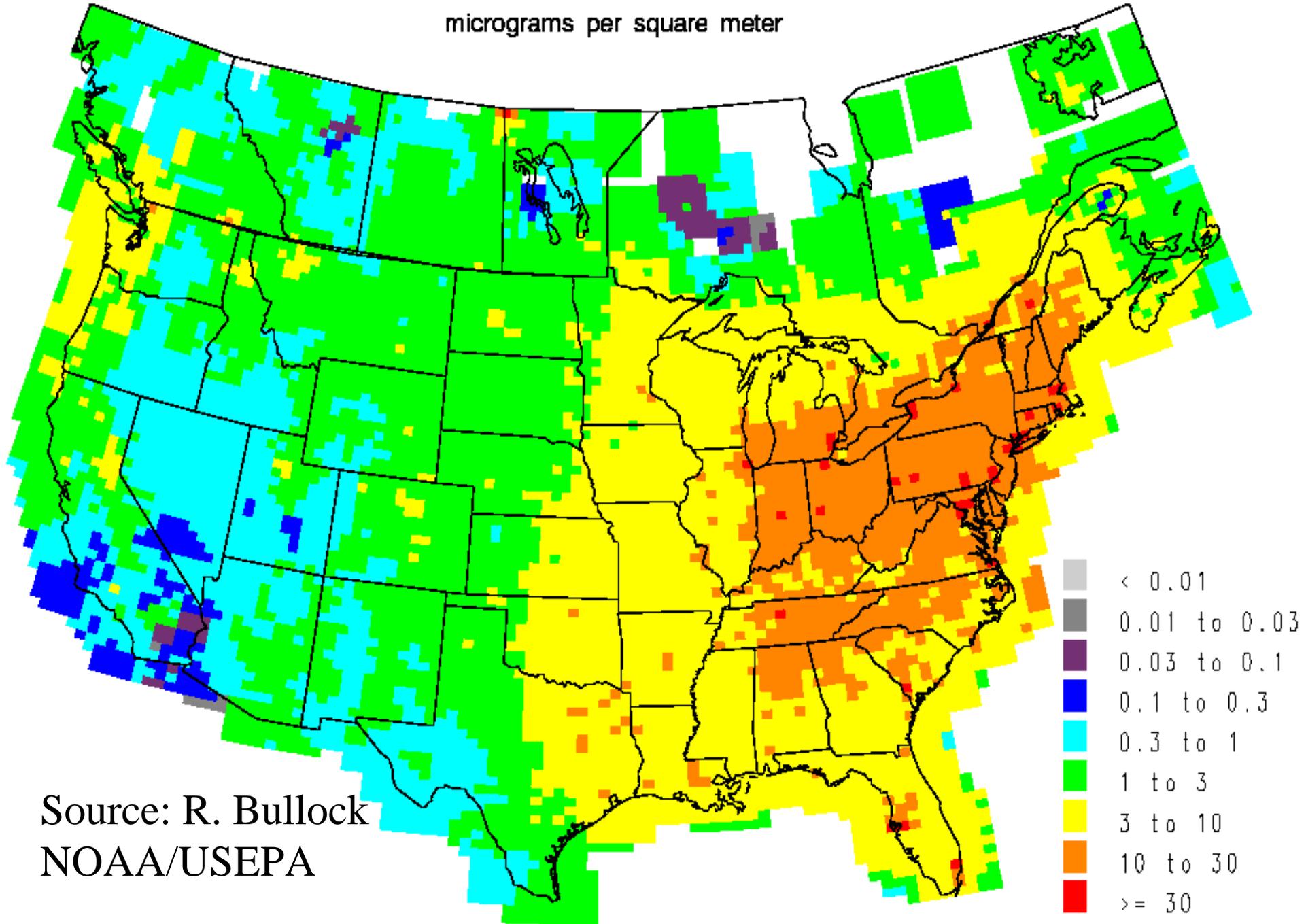
Regional Atmospheric Mercury Emissions (percent of total man-related emissions)



Source: EERC Rept., v. 9, no. 1, 2003

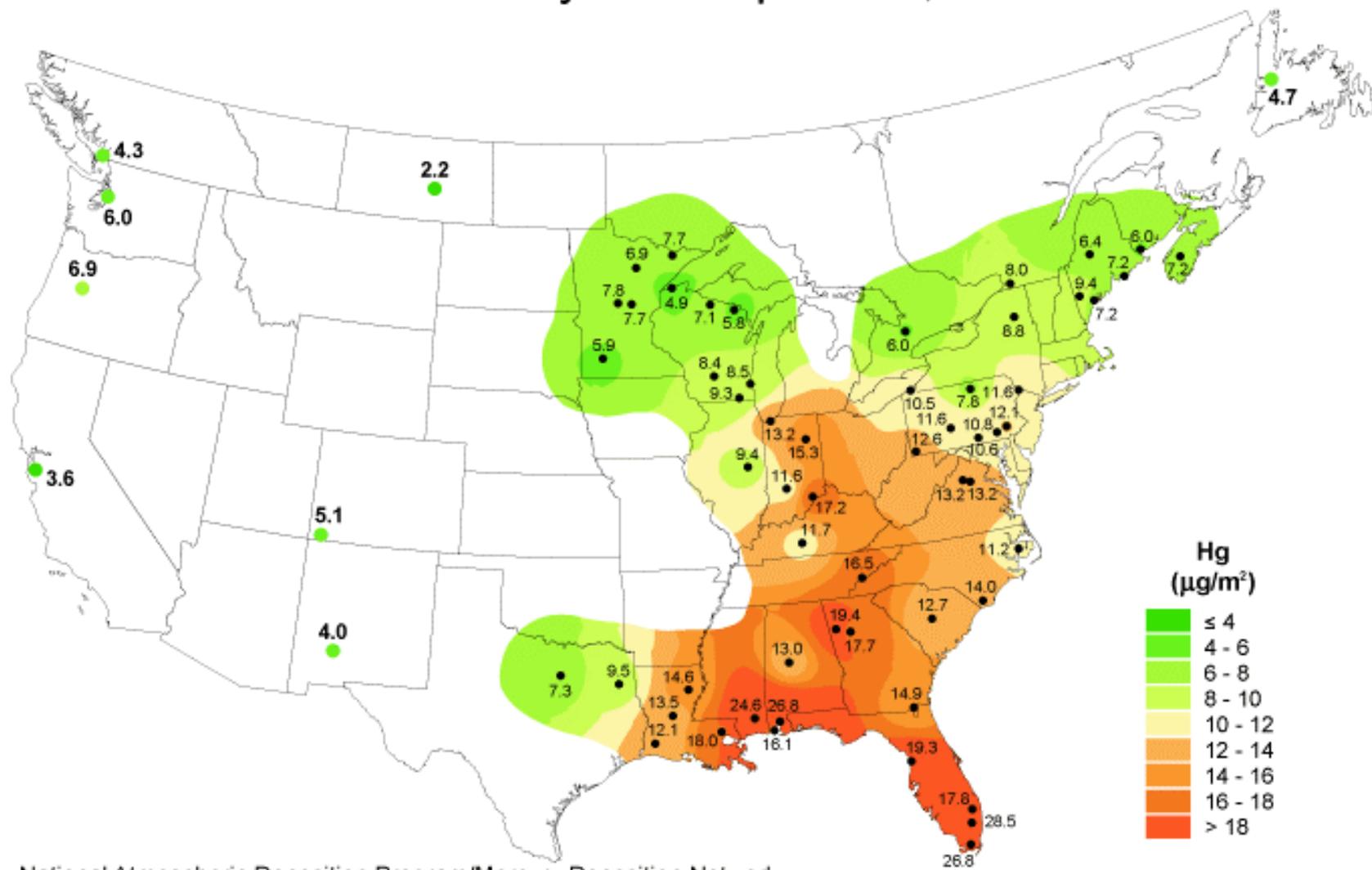
Wet Deposition – Total Hg from USA, Canada and Background

micrograms per square meter



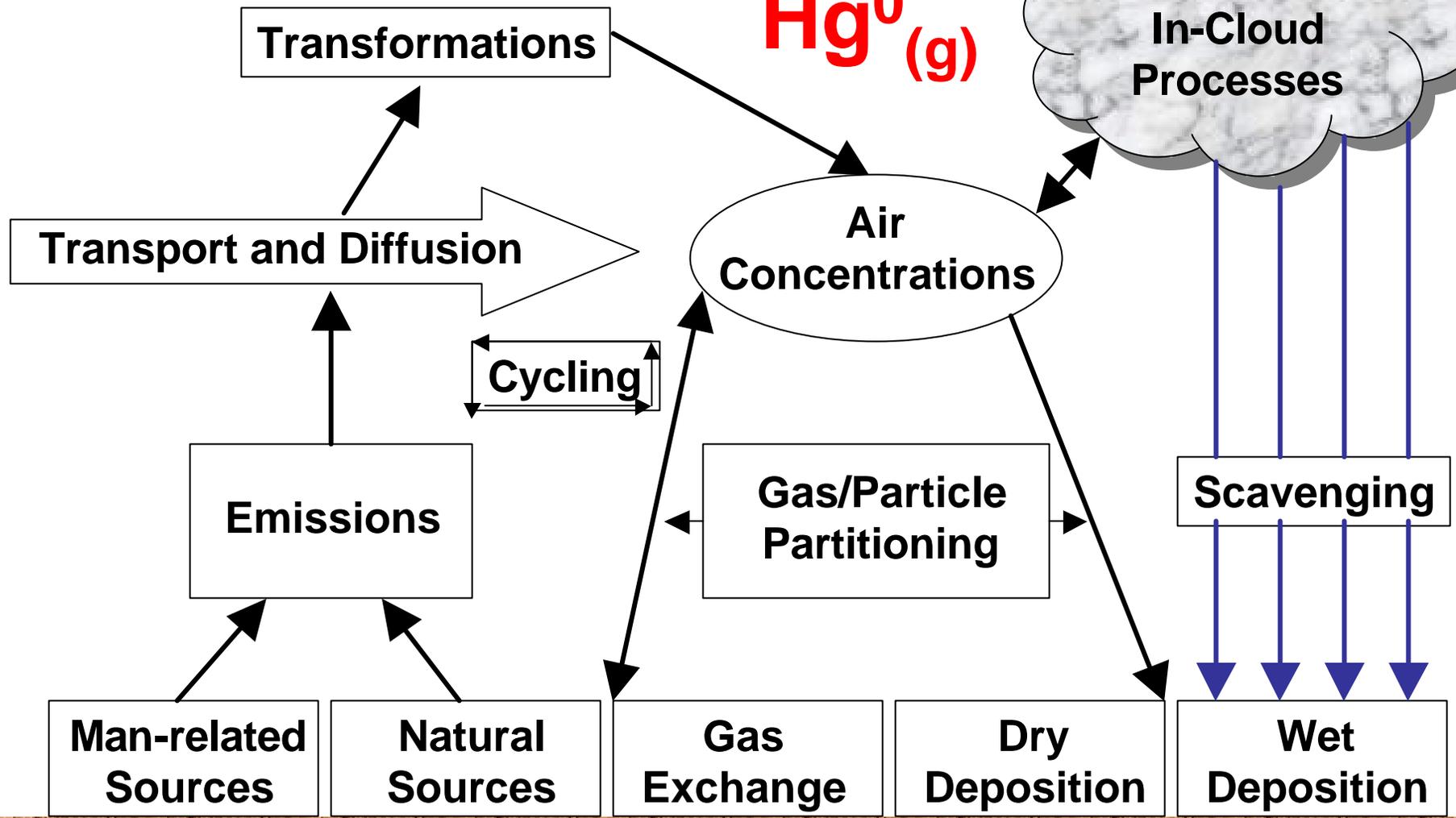
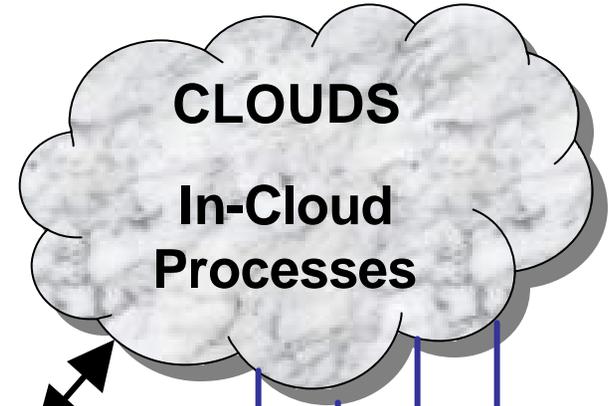
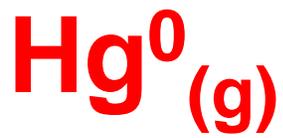
Source: R. Bullock
NOAA/USEPA

Total Mercury Wet Deposition, 2003



National Atmospheric Deposition Program/Mercury Deposition Network

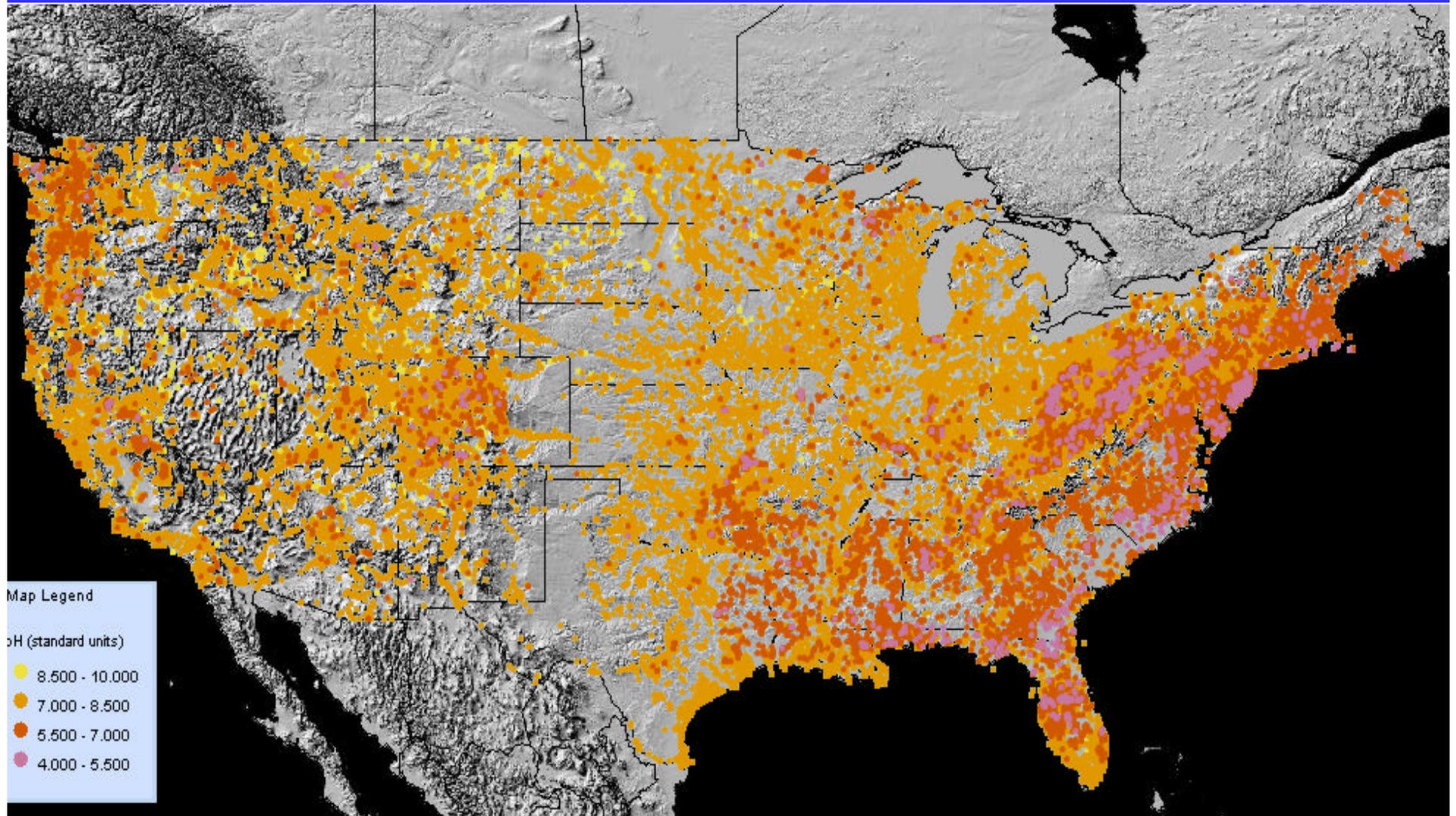
ATMOSPHERE

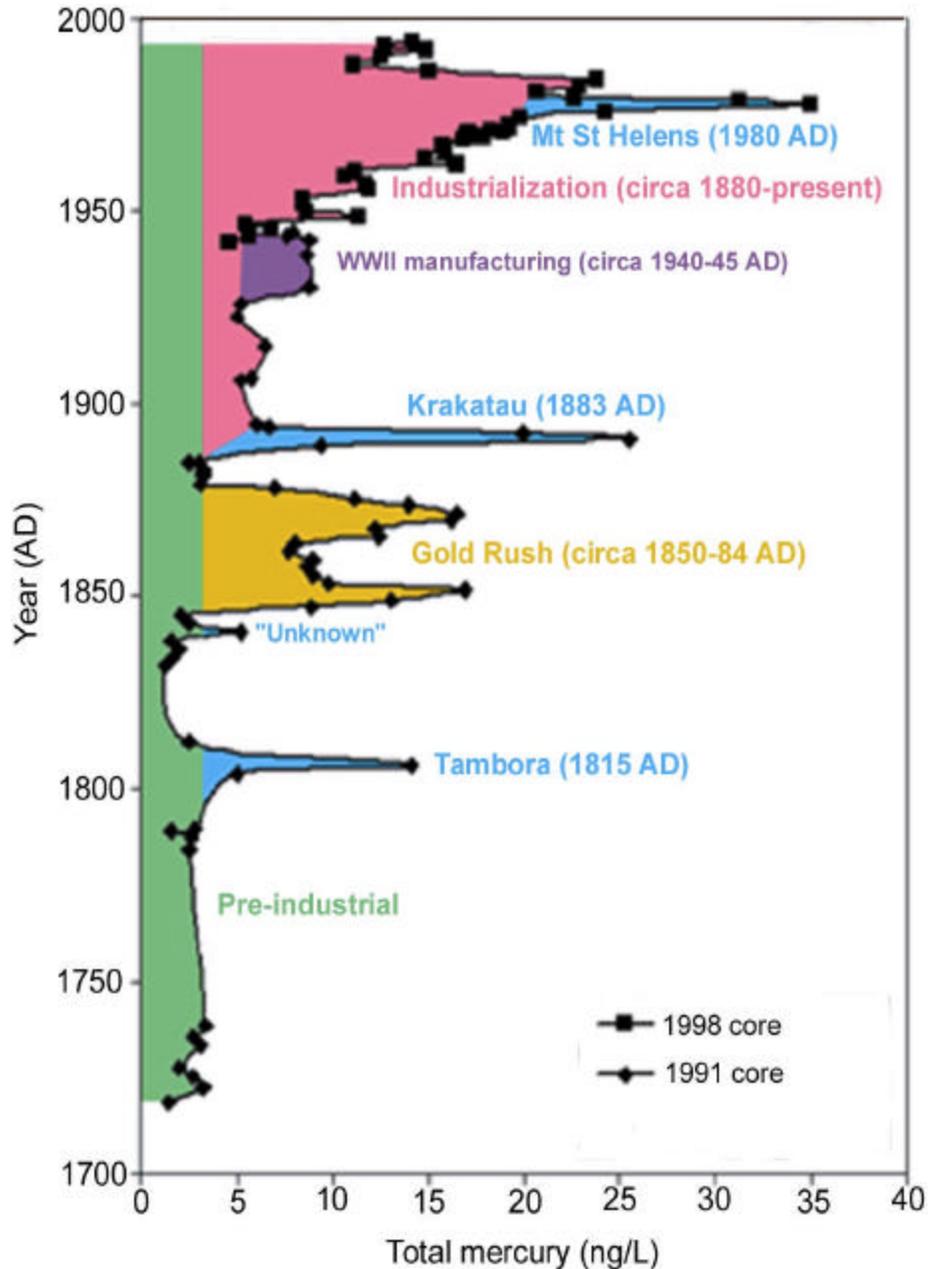


EARTH'S SURFACE (water, soil, vegetation)

“Emissions-to-deposition cycle” (Adapted from Schroeder and Munthe, 1998)

Does it matter where the mercury deposits? Surface Water pH (30 year mean)





Lessons from the Freemont Glacier:

270-year record

Large changes in mercury
deposition

Regional-to-global scale
impacts from varying Hg
sources.

70% of Hg accumulation
over the past 100 years
resulting from man's
activities

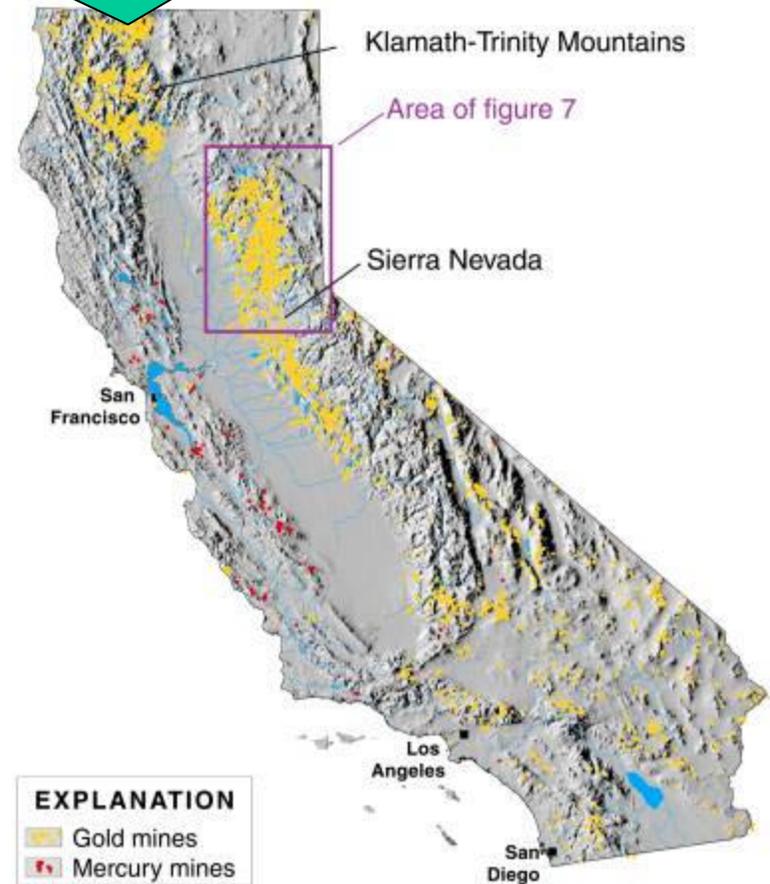
Distinct decline last 10
years

California Mercury Production

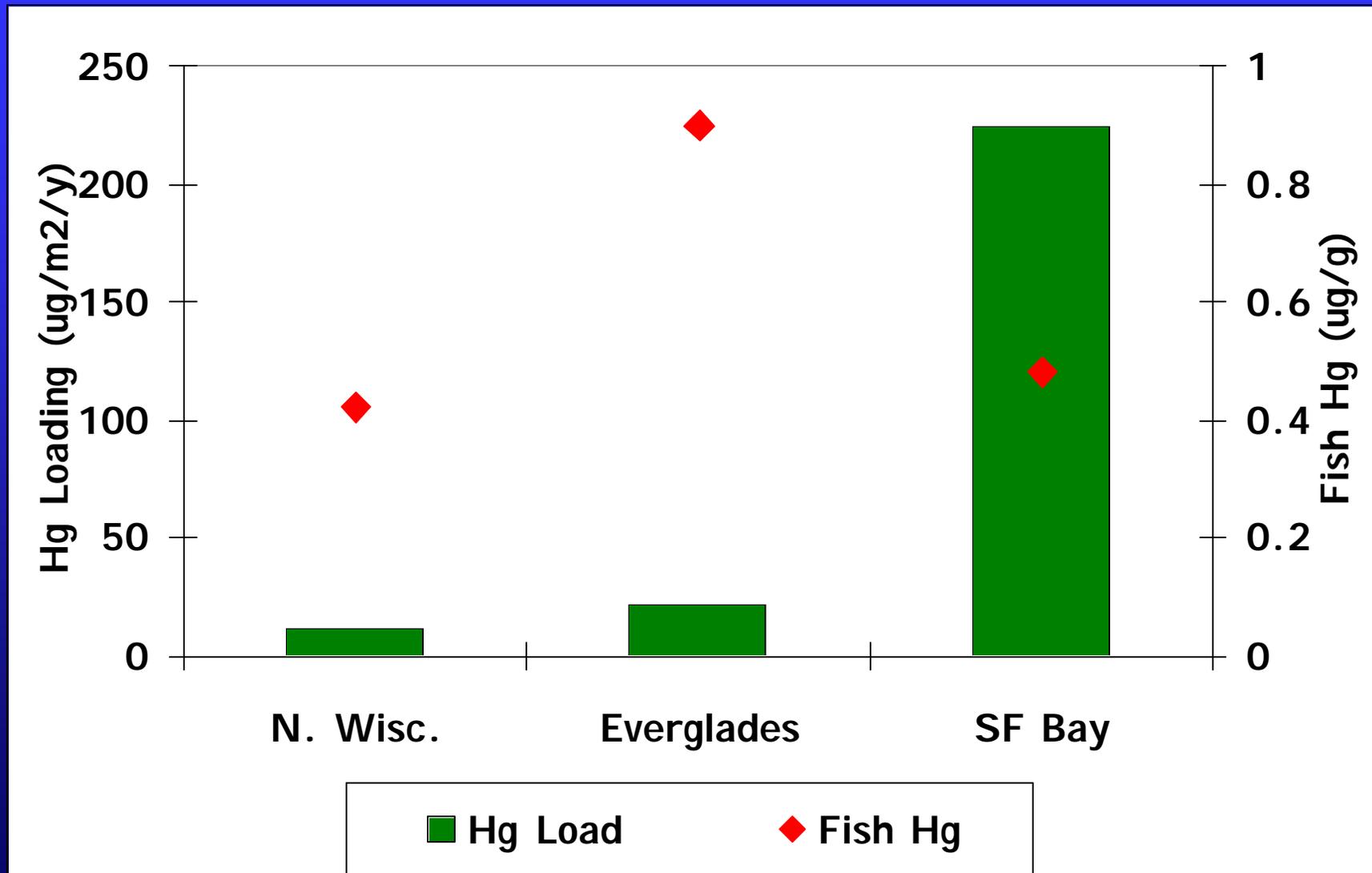
Historical mercury problems: California example

Legacy of historical mercury uses that 150 years later are now sources

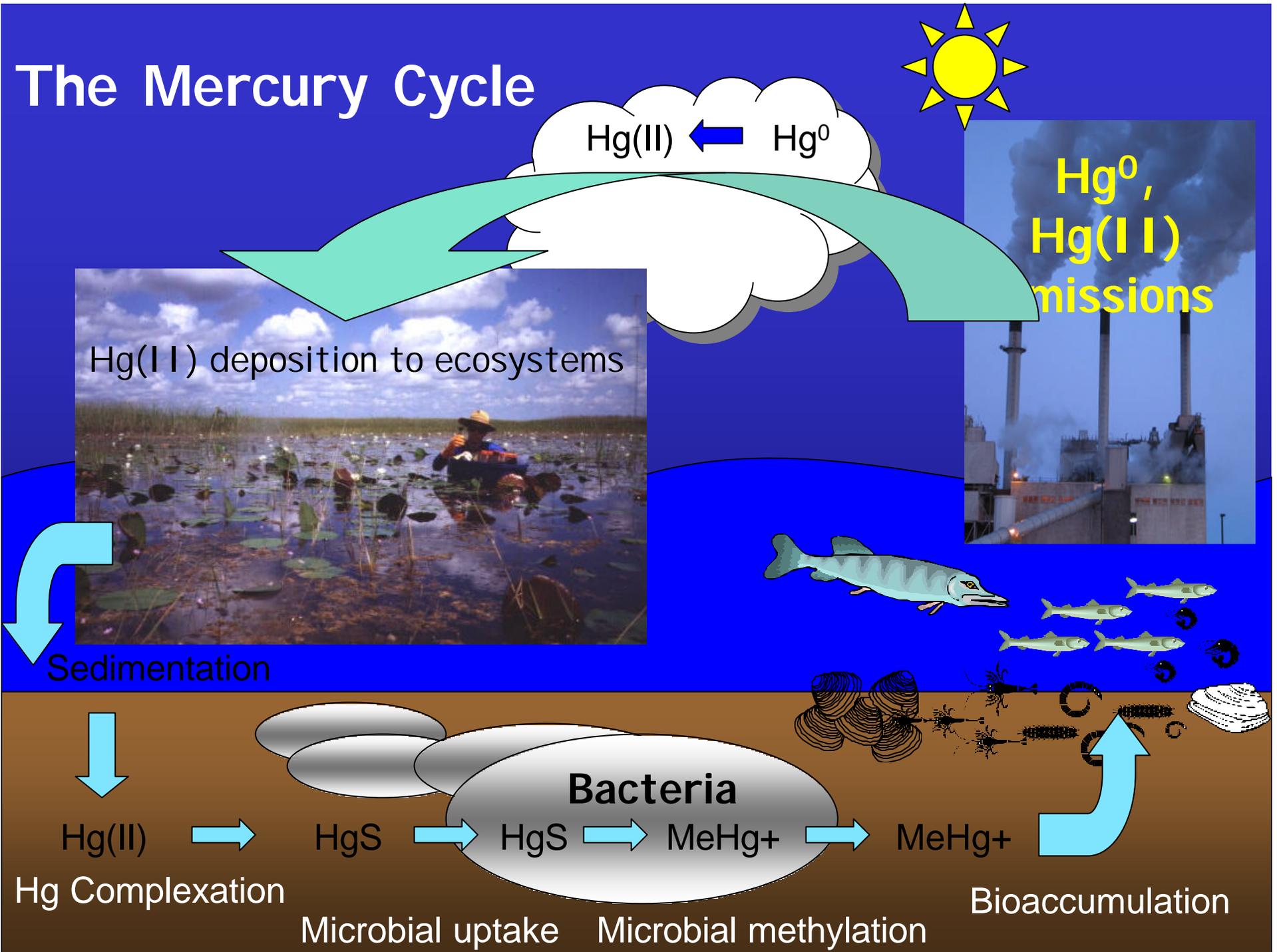
Figures from C. Alpers



Relating Sources and Loading to Bioaccumulation - Bioavailability is the Key

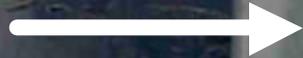


The Mercury Cycle

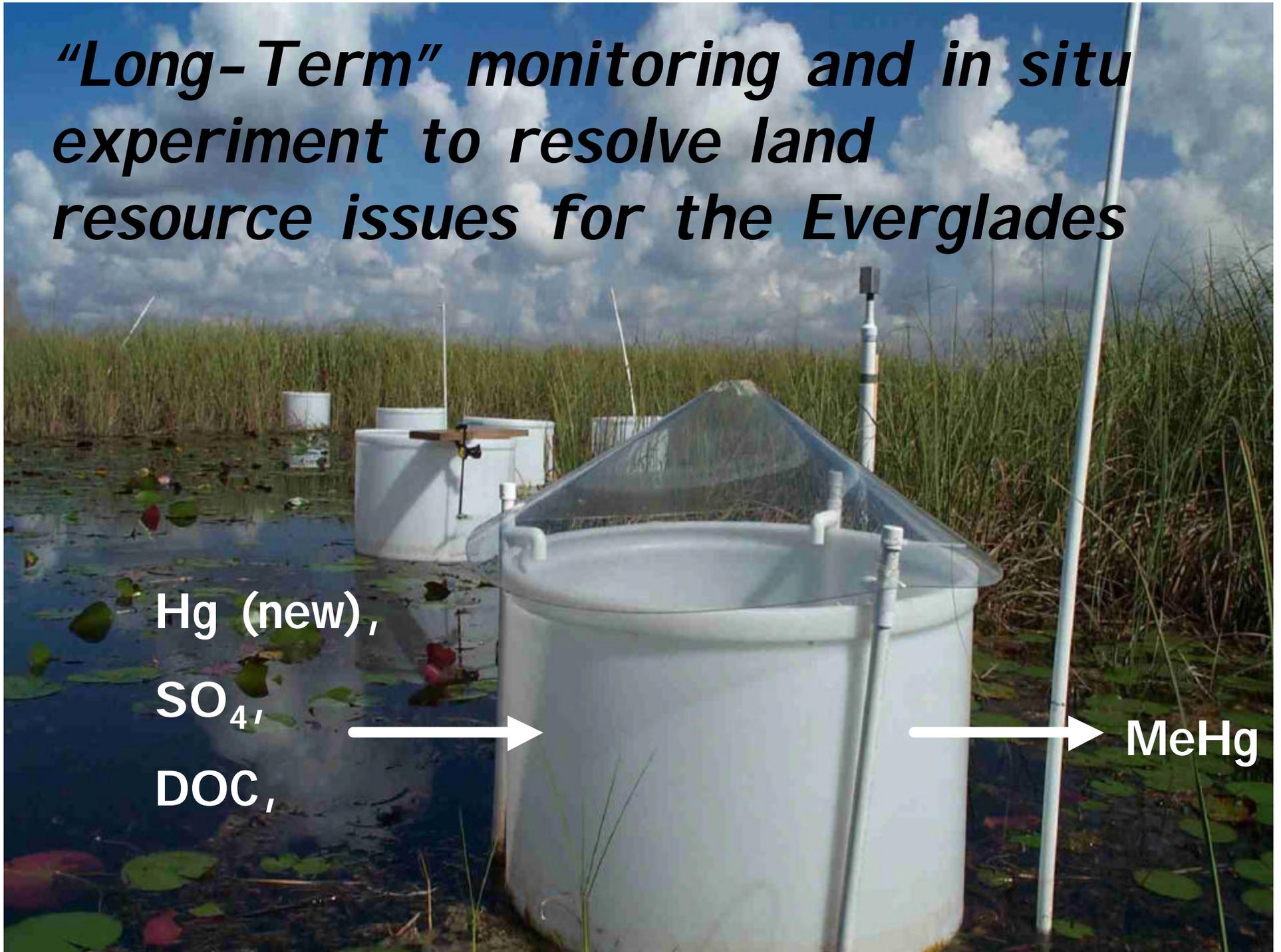


“Long-Term” monitoring and in situ experiment to resolve land resource issues for the Everglades

Hg (new),
SO₄,
DOC,



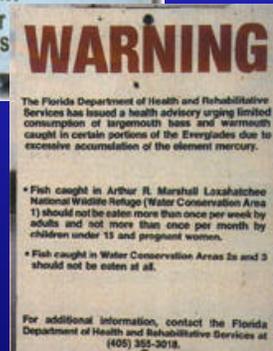
MeHg



"The Mercury Axis of Evil"



Sulfur

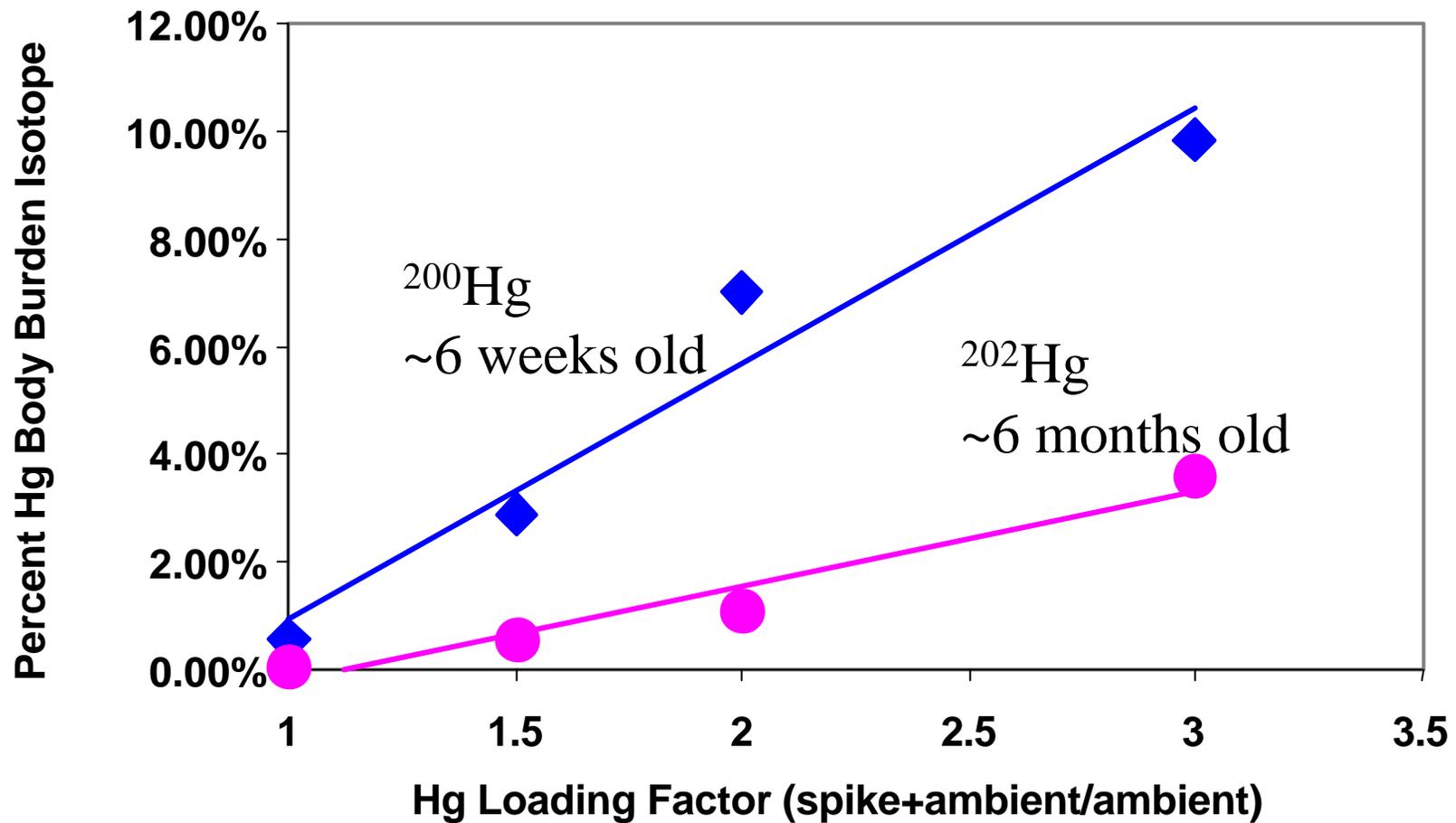


Mercury

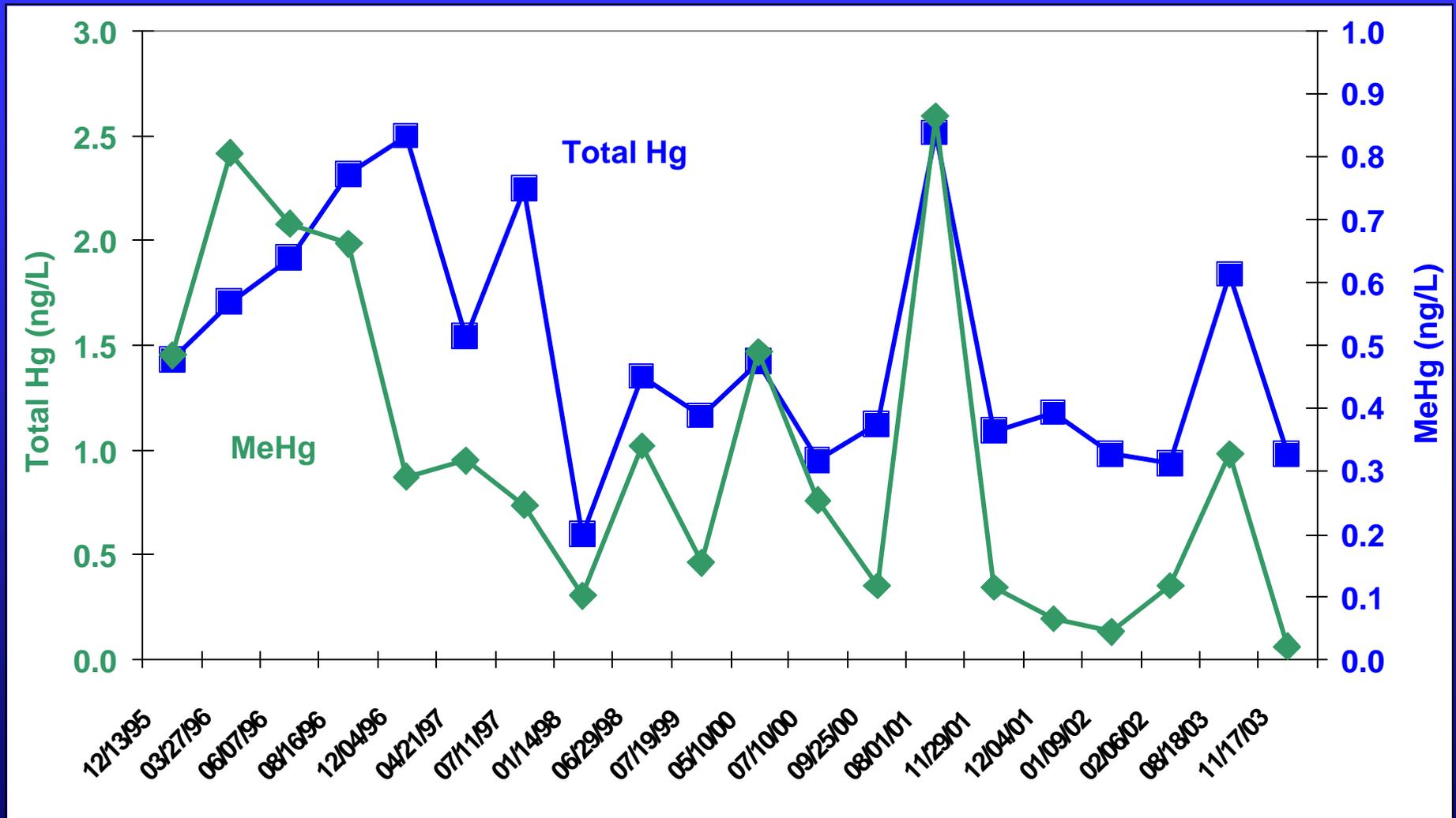


Carbon

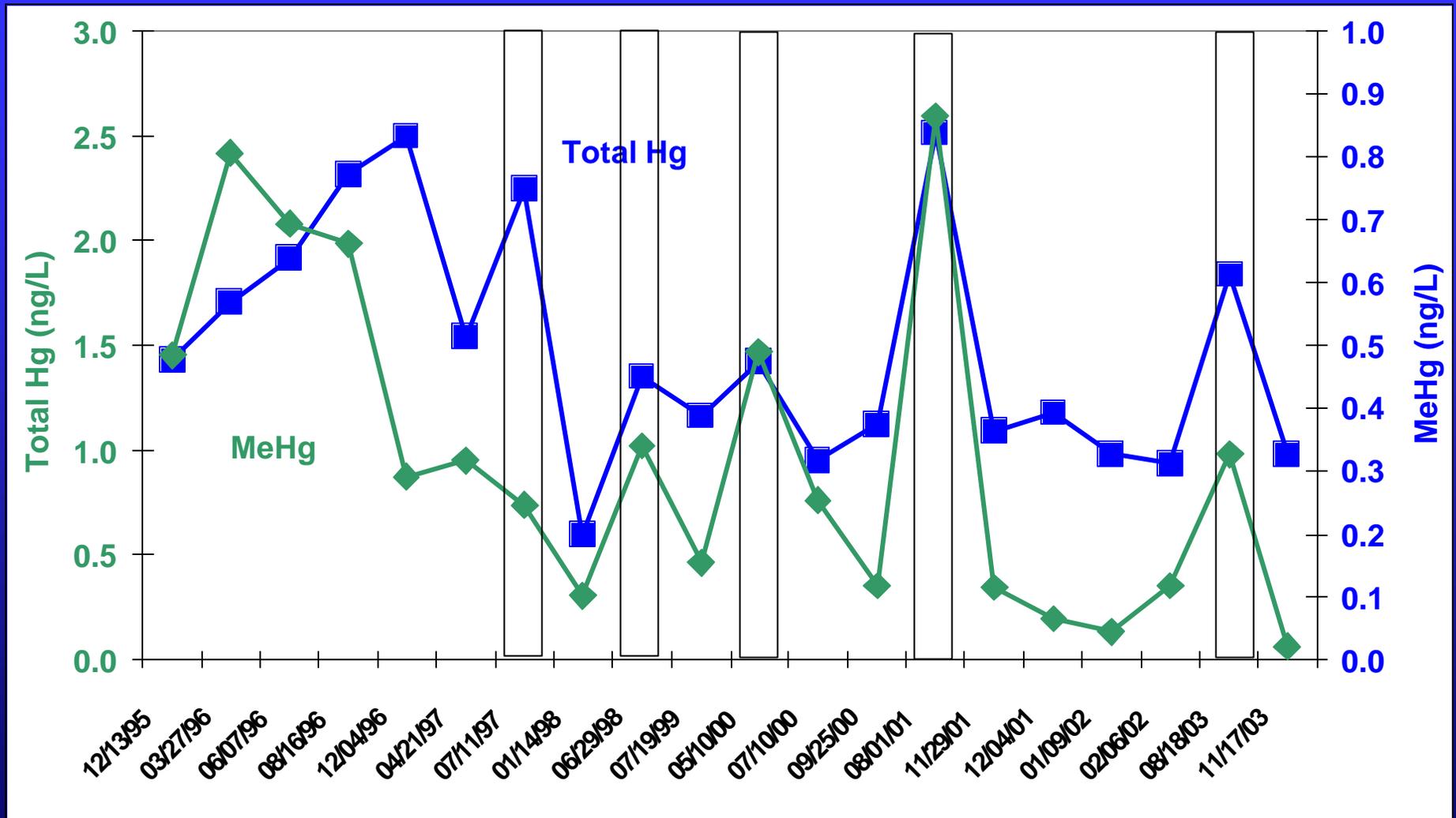
Bioaccumulation of New vs. Old Mercury by Gambusia



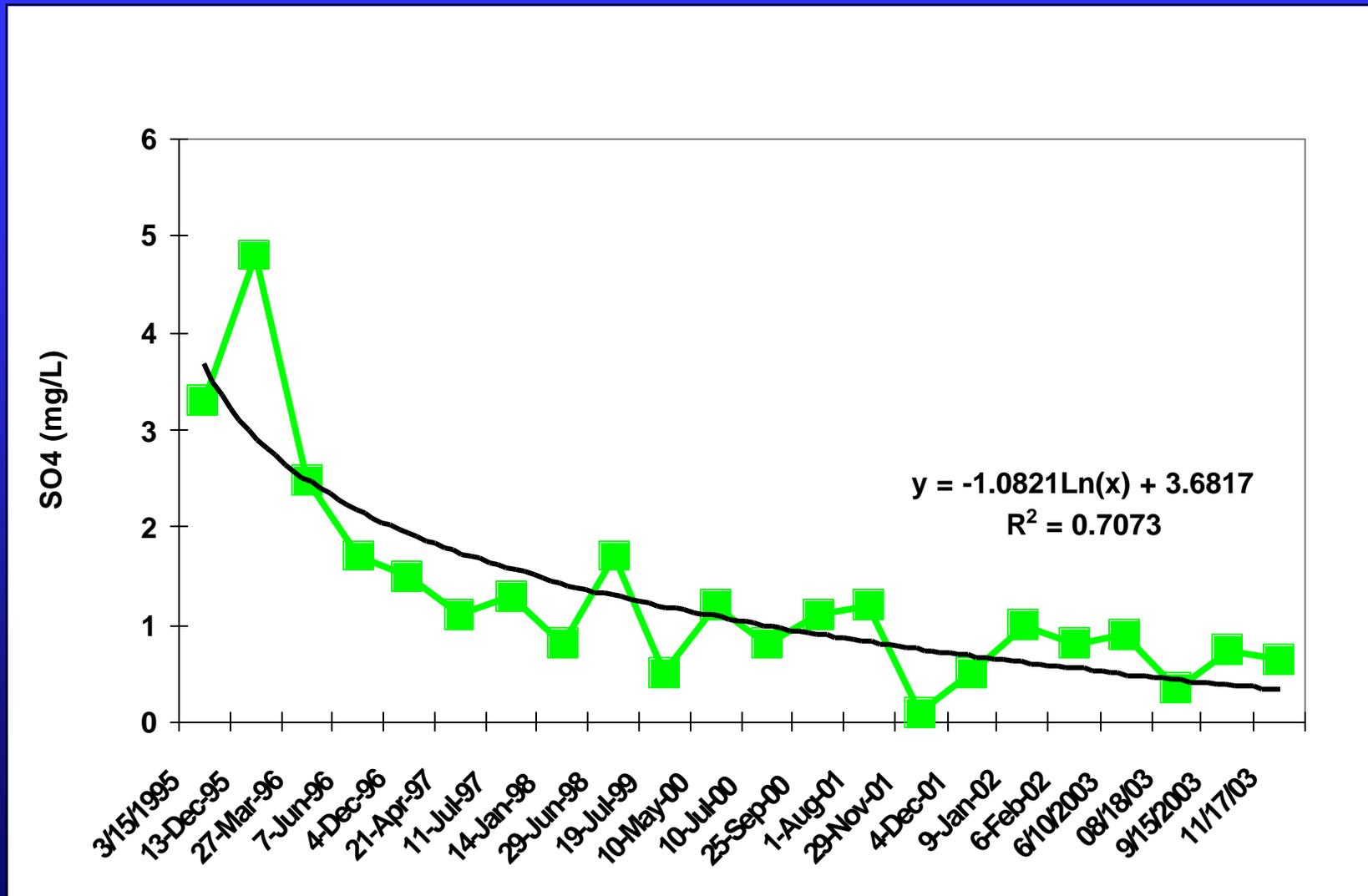
But, what about between the spikes



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Sulfate Time Series



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- Many factors have controlling effects: Hg loading rate, water chemistry (S, C, & Hg), hydrology (wetting & drying, watershed inputs, floods), disturbances (fire, dredging, global warming) and land management (wetland restoration & construction, reservoir construction, erosion, mining, mine restoration, fire, land-use changes)



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→ It's not just Hg loading!



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- Human & wildlife toxicology
- Science integration and science-policy linking



The Scientific and Management Challenge: Reducing Exposure to Methylmercury

Approach

Fish advisories

Emissions reduction

Landscape
management

Objective

Protect human health

Decrease Hg available
for methylation in
the environment

Decrease production of
MeHg in ecosystems
(Everglades Examples)

8th International Conference on Mercury as a Global Pollutant

Mercury 2006 August 6-11, 2006 Madison, Wisconsin U S A

[invitation](#) | [history](#) | [organizing committee](#) | [sponsorship](#) | [technical sessions](#) | [exhibitors](#) | [venue](#) | [city of madison](#) | [state of wisconsin](#) | [getting to/from](#)

An Invitation to the Eighth International Conference on Mercury as a Global Pollutant

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Madison, Wisconsin, USA

Complete information at:

www.mercury2006.org